Issues in B's and CKM Matrix Elements

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- What's new in RPP 2006
- Issues in B's
- Issues in CKM Elements
- New Minireviews
- Prospects for 2008 Edition

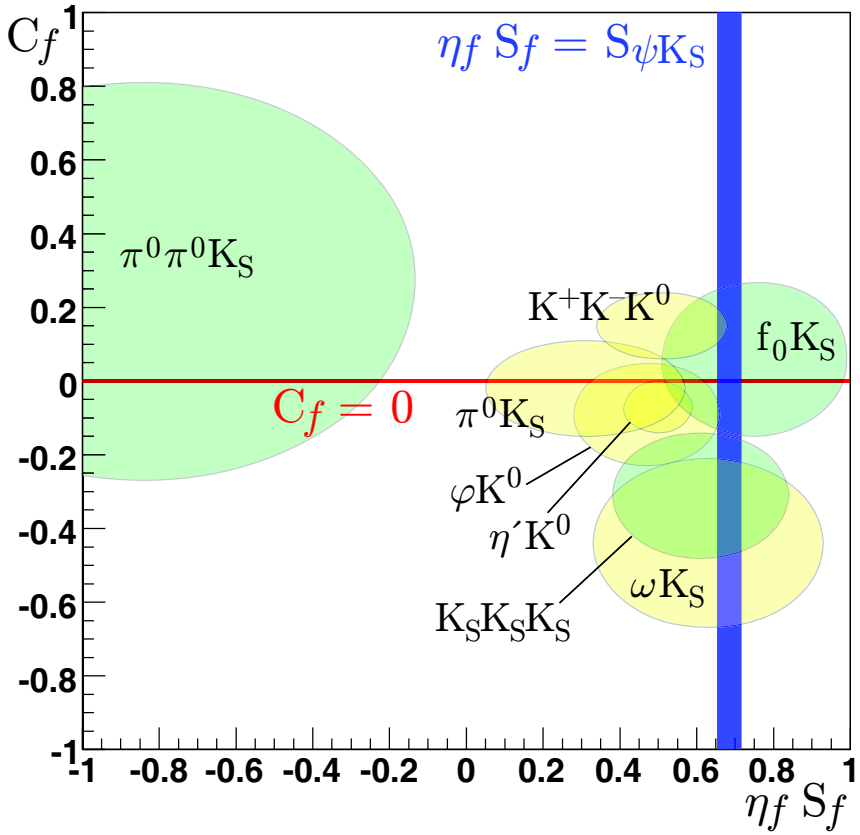
Encoders:

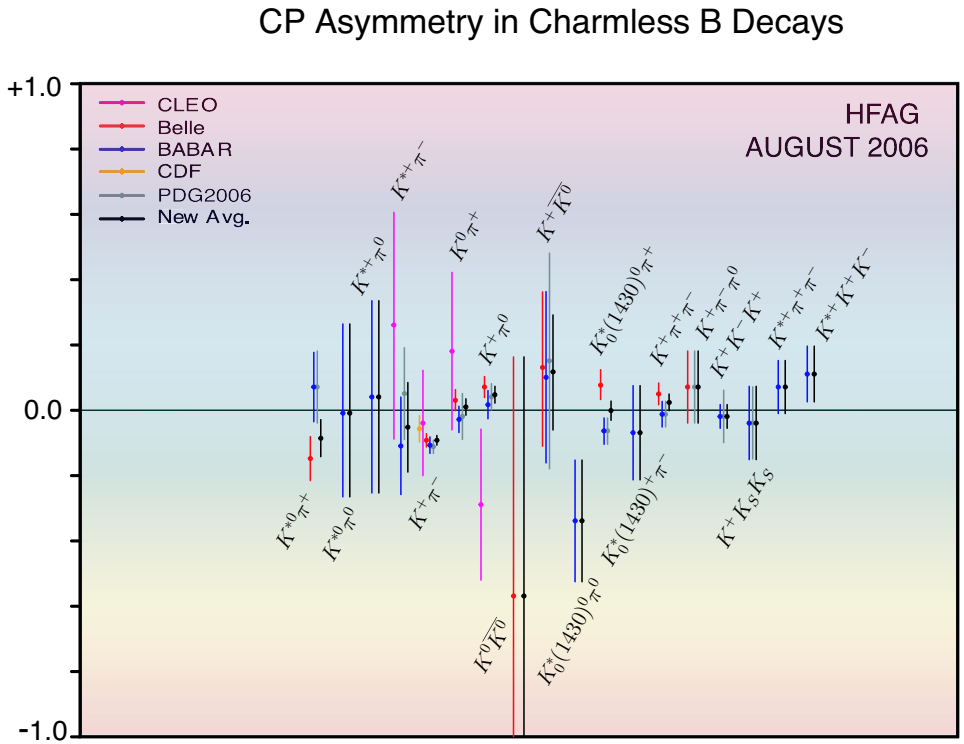
- Y. Kwon(Yonsei, Korea), Jim Smith(Colorado, USA) and Giovanni Punzi(INFN, Italy)
- With the help of Heavy Flavor Averaging Group (HFAG)

What's New in RPP 2006

- B physics continues to be one of the most productive fields in RPP.
- There were 186 papers and 780 measurements encoded since RPP2004.
- Highlights:
  - CPV and Unitarity Triangles
  - Bs Mixing and B lifetimes
  - Rare B Decays, Searches and Observation of $B_c \to J/\psi\pi$
  - Semileptonic B decays and V_{cb} and V_{ub} elements
- Excellent minireviews:
  - B production and Decays – Revised (Y. Kwon and G. Punzi)
  - $B\bar{B}$ mixing – Revised (O. Schneider)
  - V_{cb}/V_{ub} determinations – New (B. Kowalewski and T. Mannel) and
  - B polarization – New (A.V. Gritsan and J.G. Smith)

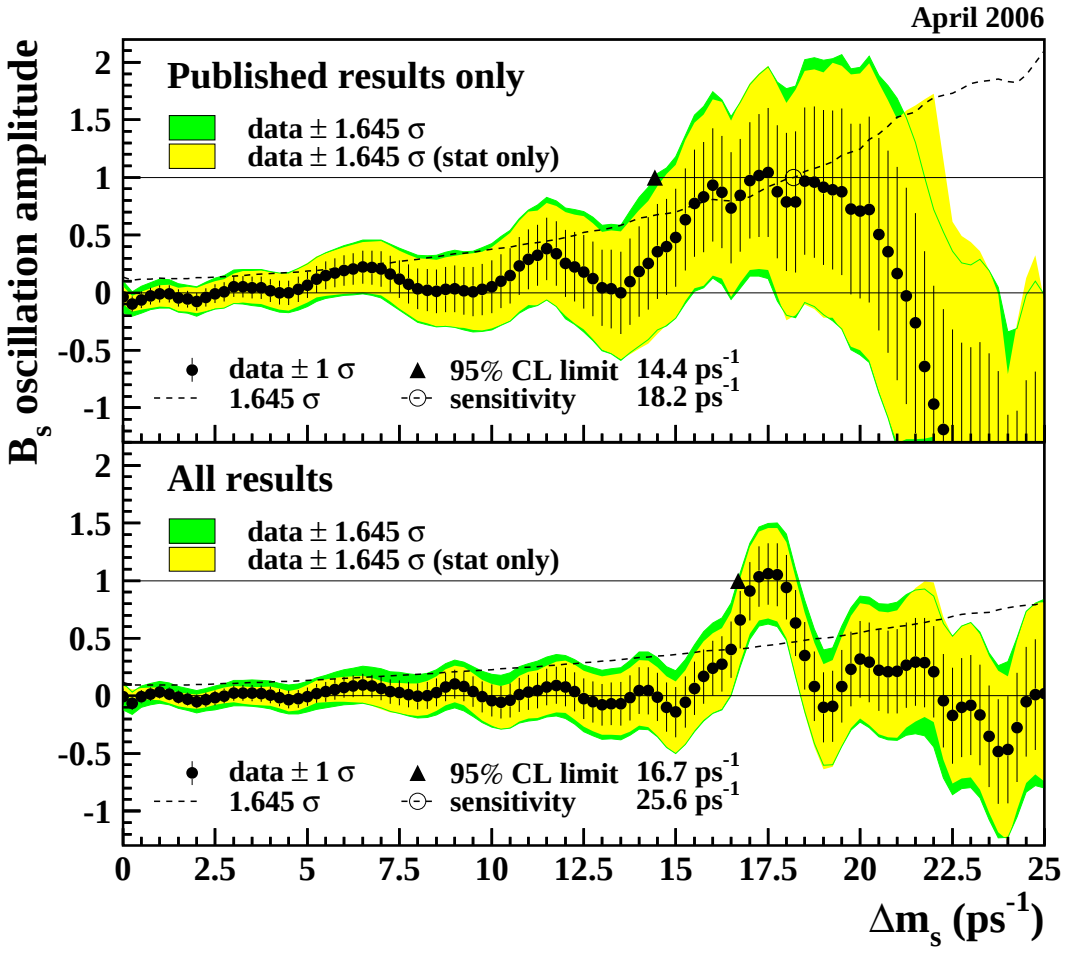
CPV and Unitarity Triangles





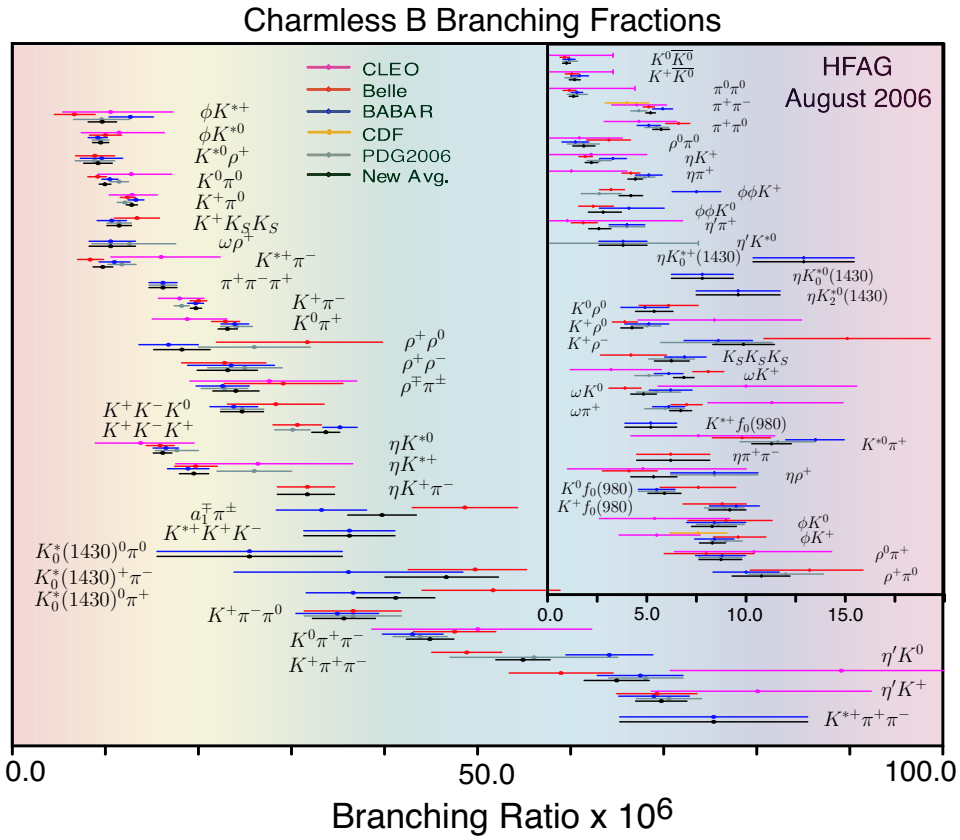
- $Sin2\beta(\phi_1) = 0.687 \pm 0.032$
- $A_{CP}(B^0 \to K^+\pi^+) = -0.115 \pm 0.018$

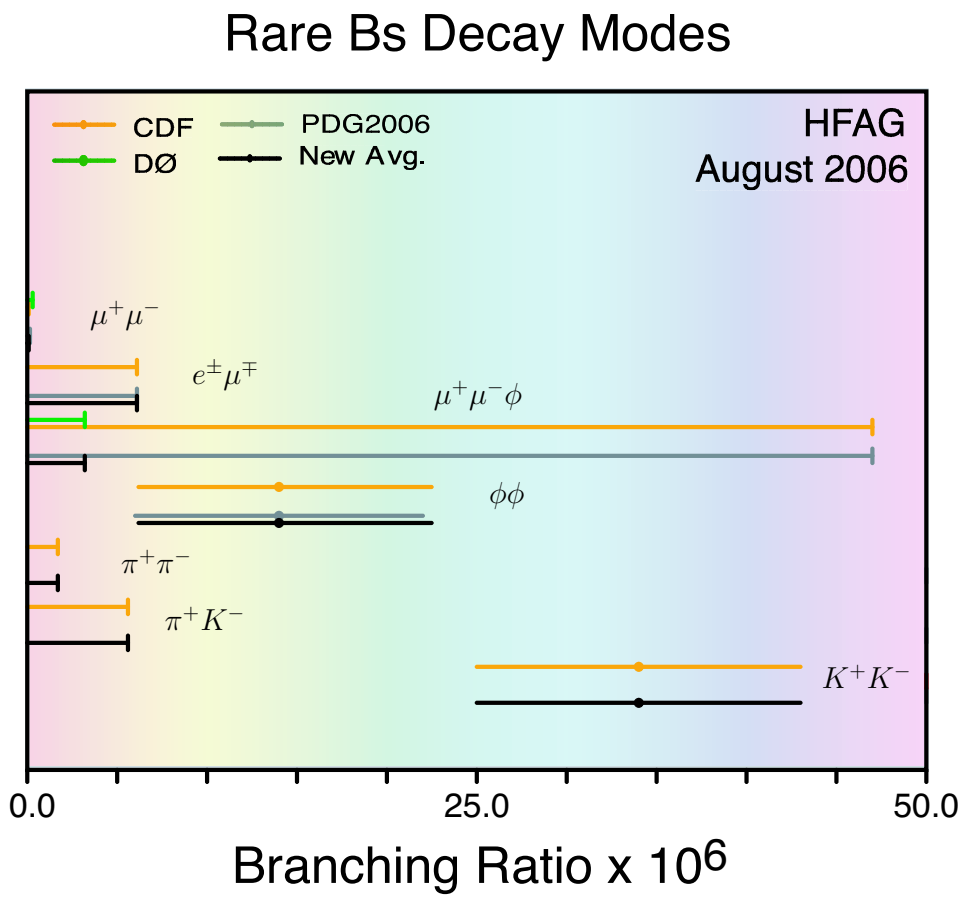
Evidence for Bs Mixing



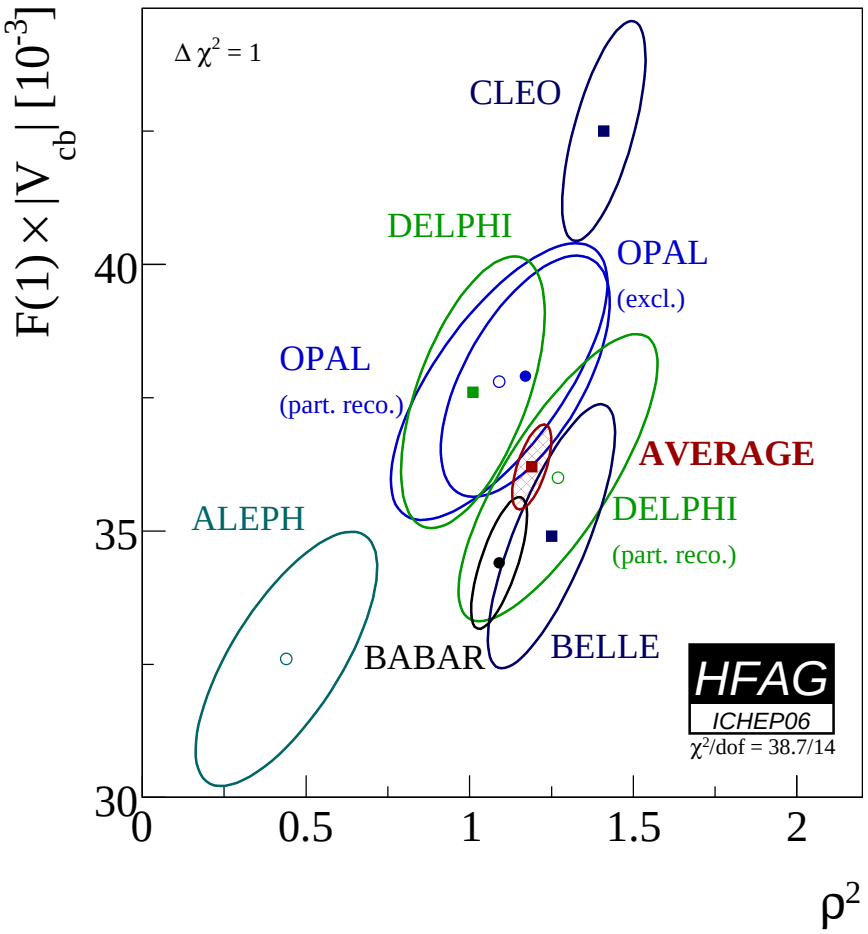
- $\Delta m_s = 17.4^{+0.3}_{-0.2}(ps^{-1})$ (Preliminary World Aveage)
- $\Delta m_s = 17.31^{+0.33}_{-0.18} \pm 0.07(ps^{-1})$ (CDF, PRL 97, 062003 2006)
- $|V_{td}/V_{ts}| = 0.208^{+0.008}_{-0.007}$

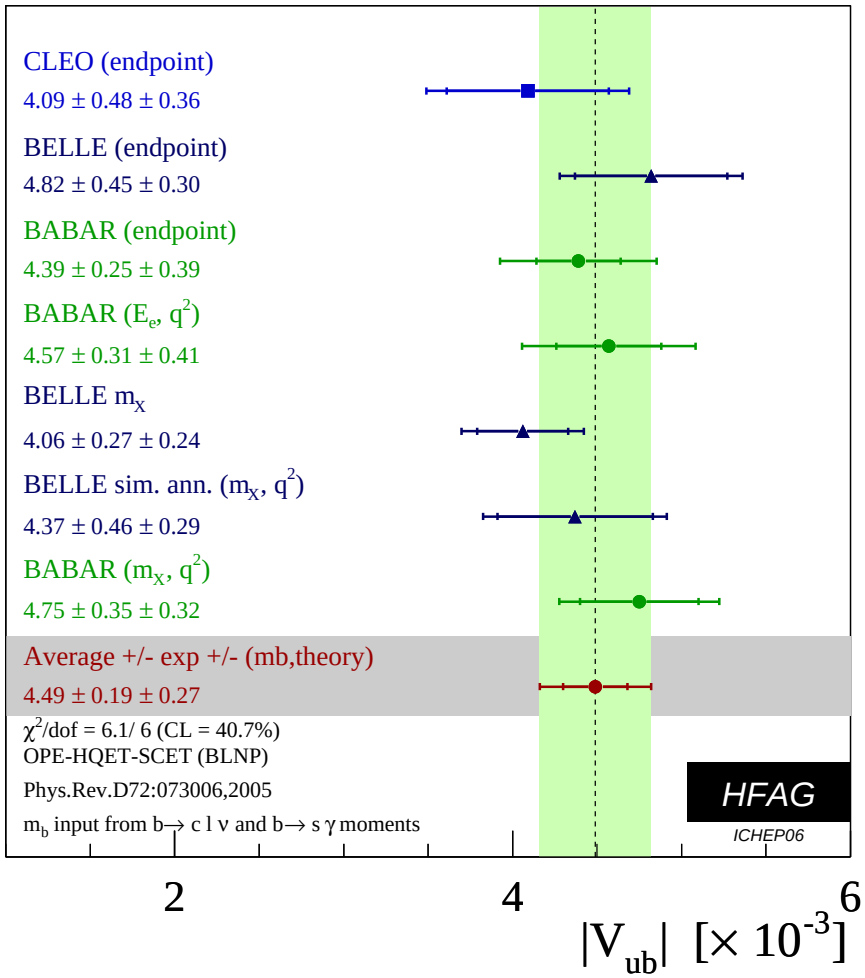
Rare Decays and Searches





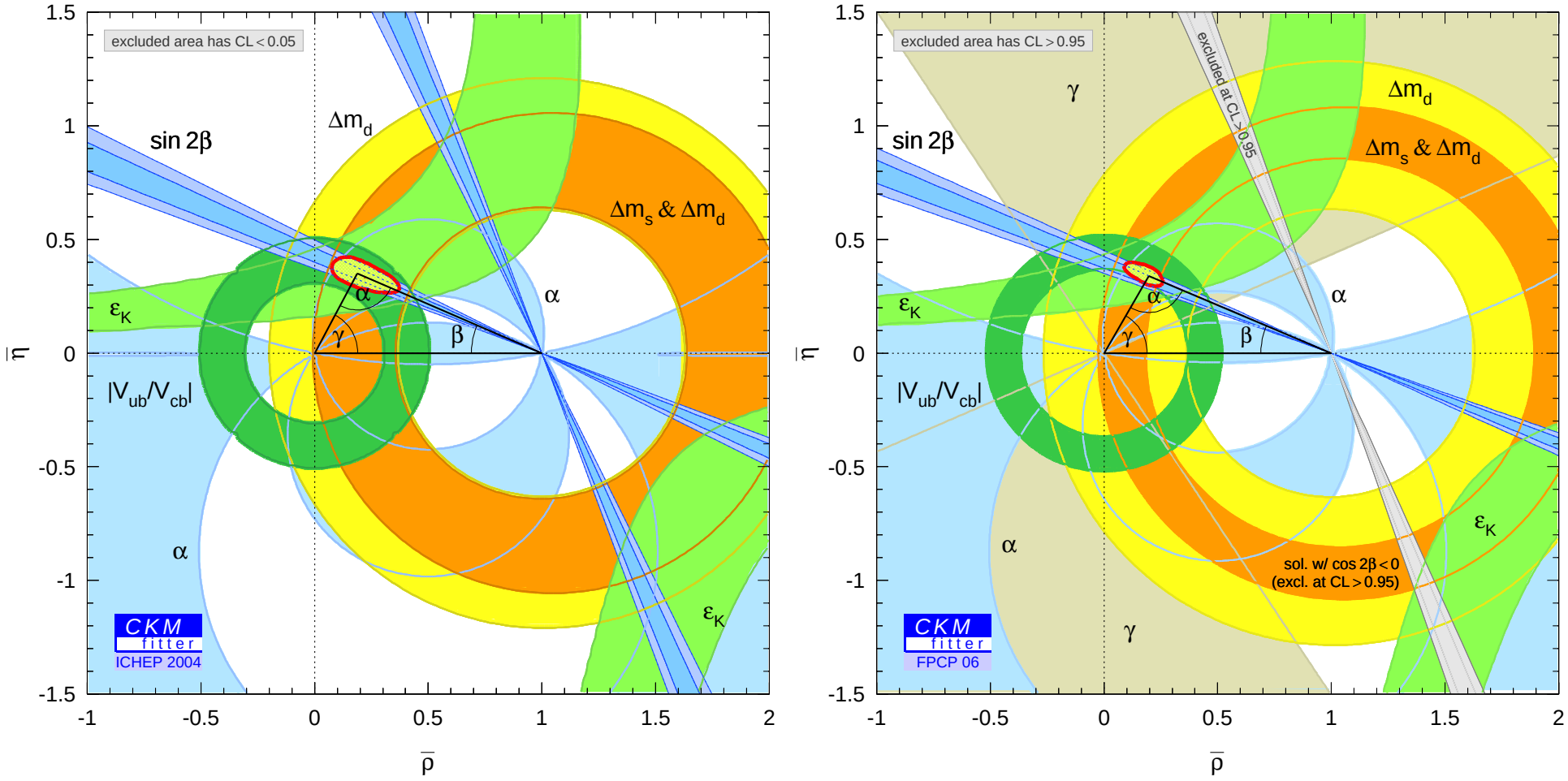
$|V_{cb}|$ and $|V_{ub}|$ Measurements





- $|V_{cb}| = (40.9 \pm 1.9) \times 10^{-3}$ (exclusive)
- $|V_{cb}| = (4.40 \pm 0.20 \pm 0.27) \times 10^{-3}$ (inclusive)

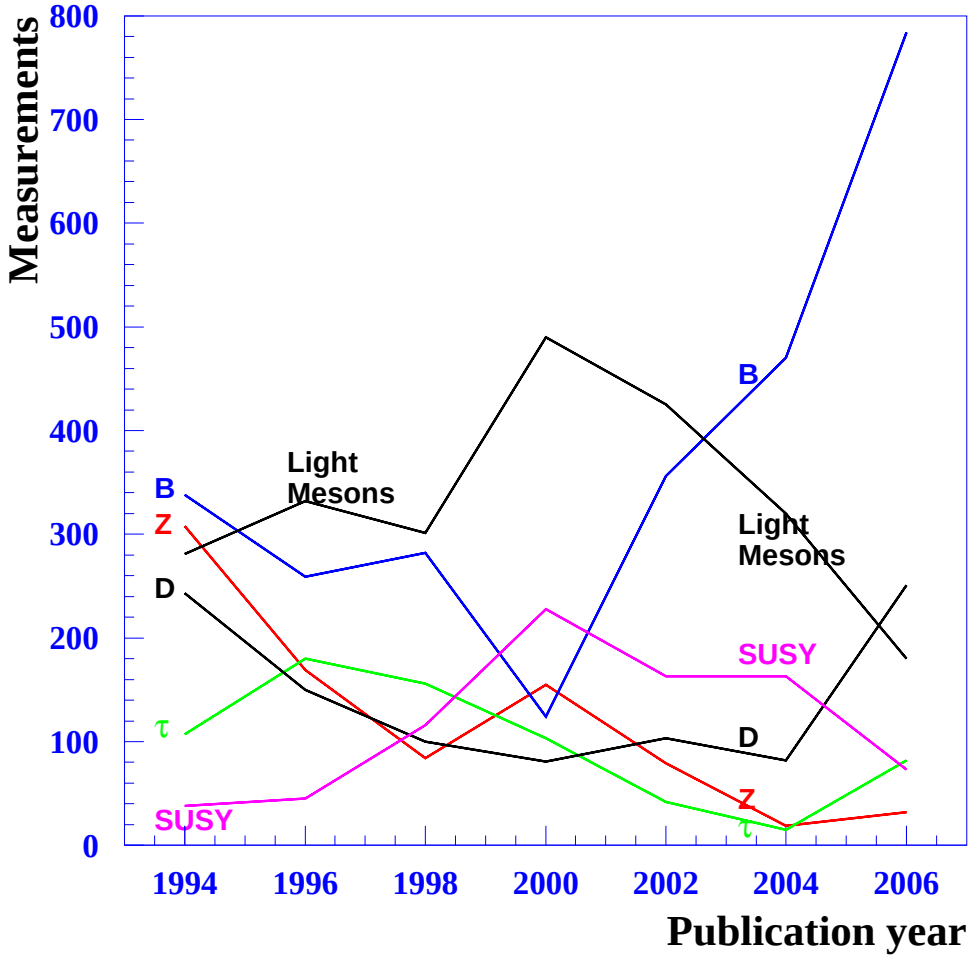
CKM Fits



- Left: 2004 CKM fit; Right: 2006 CKM fit
- A significant improvement is evident.

Issues in B Sections

- The number of B measurements has increased 85% per edition since 2000.
- Expected to continue rising through Super B and LHC era.
- OK so far, but PDG computer upgrades are crucial for the future success.



Outside Working Groups (HFAG)

- The PDG averaging method is no designed for handling possible correlations in statistical and systematic error between measurements and experiments.

- We have to rely heavily on the outside working groups and their expertise to provide the best averages for the community.

- HFAG combination procedure takes all known correlations into account as well as rescaling each individual measurements using the common set of input parameters before averaging.

- HFAG consists of 6 subgroups
  - B Lifetimes and Mixing
  - Semileptonic B Decays
  - Unitarity Triangle
  - Rare B Decays
  - $b \to c$ Decays
  - Charm Physics

The Limit vs The Central Value

- We usually quote the best limit when the measurement is not significant ($< 3\sigma$)
- It would not matter for single measurement, but it would not take the advantage of improvement by combination of two or more comparable measurements.
- There are usually both limit and central value exist in the paper regardless the result significant or not.
- This would allow us to combine the central results and decide if the limit is needed or not.
- For most of CPV searches, we are quoting the central value in the list and the limit in the footnote.
- It avoids the trouble to quote two side upper limits in current RPP system.

$|V_{td}/V_{ts}|$ CKM elements

- Radiative B decays (BELLE):
  - $B(B \to \rho\gamma)/B(B \to K^*\gamma) = |V_{td}/V_{ts}|^2/\xi^2$
  - $|V_{td}/V_{ts}| = 0.16 \pm 0.04$ for $\xi = 1.2 \pm 0.2$
- Bs mixing (CDF):
  - $\Delta ms = 17.33^{+0.33}_{-0.18} \pm 0.07(ps^{-1})$
  - $|V_{td}/V_{ts}| = 0.208^{+0.008}_{-0.006}$
- They are discussed in CKM review
- Shall we keep the way as is ? since these are derived quantities and most of branching ratios and Bs mixing are in the data listing already.

New V_{cb} and V_{ub} Minireview (New)
B. Kowalewski and T. Mannel

- Following the PDG advisory committee's recommendation, we have successfully combined two separate V_{cb} and V_{ub} minireview into a single coherent review, which covers both theoretical and experimental issues regarding V_{cb} and V_{ub} measurements

- The authors have done a nice job to describe both theoretical and experiment issues involved in the measurements.

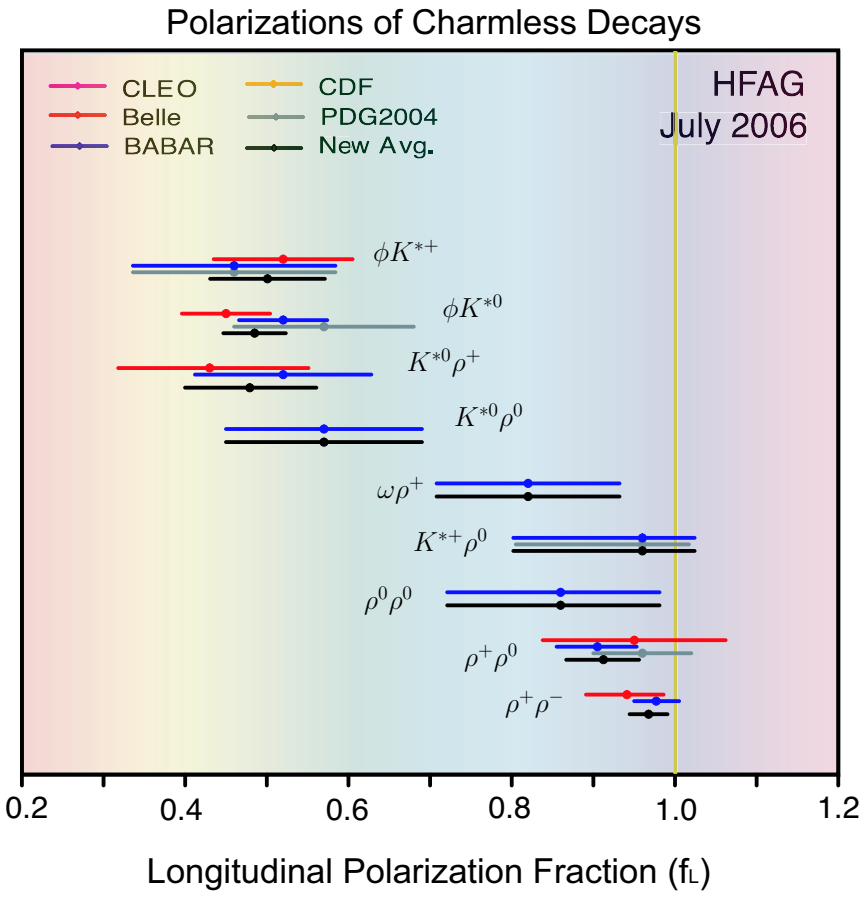
- They have incorporated all the referee comments that they have received and most of them are quite positive.

- The values obtained from inclusive and exclusive determinations are consistent each other and an average values is used for the final result.
  - $V_{cb} = (41.6 \pm 0.6) \times 10^{-3}$
  - $V_{ub} = 4.31 \pm 0.30) \times 10^{-3}$

Polarization in B Decays (New)

A.V. Gritsan and J.G. Smith

- Review the notation and discuss CPV observables used in polarization measurements
  - B, f_L, $f_\perp$
  - $\phi_\parallel$, $\phi_\perp$, $\Delta\phi_\parallel$, $\Delta\phi_\perp$
  - A_{CP}, A^0_{CP}, $A^\perp_{CP}$
- Some old measurements were missing and will be included for next web edition.



Prospects for 2008 Edition

- Continue to work with Heavy Flavor Averaging Group providing the world best B decay parameters

- Planning for a new set of minireviews
  - V_{cb} and V_{ub} CKM Elements
  - Production and Decay of b-flavor Hadrons
  - Polarization in B decay
  - B Mixing
  - ...

- All the data are consistent with Standard Model so far, will see if that still holds at 2008.

- This is an exciting time for heavy quark physics and we will be ready for the challenges in LHC and super B factories era.